

CLAIMS

1. Process for coating substrates with a polar coating by means of plasma polymerisation, characterised in that to produce a coating which is stable in the long term, a water-free process gas is used which contains at least one substituted hydrocarbon compound with up to a maximum of eight C-atoms and also an inorganic gas.
2. Process according to claim 1, characterised in that the proportion of organic compound in the gas mixture is between 5 and 90 volume %.
3. Process according to any of claims 1 or 2, characterised in that the inorganic gas is oxygen, a halogen, hydrogen, an inert gas, carbon monoxide, carbon dioxide, nitrogen and/or another nitrogen-containing gas.
4. Process according to any of claims 1 to 3, characterised in that an aliphatic, aliphatic cyclic and/or aromatic hydrocarbon is used.
5. Process according to any of claims 1 to 4, characterised in that as an organic compound a polyene, a monovalent or multivalent alcohol, a monovalent or multivalent carbonic acid, ether, aldehyde and/or a ketone is used.
6. Process according to any of claims 1 to 5, characterised in that as an organic compound
 - an alkane such as methane, ethane, propane, butane, pentane and/or hexane,
 - an alkene such as ethylene, butylene, propylene and/or isopropylene, or
 - an alkyne such as acetylene or a derivative of acetylene is used.

7. Process according to any of claims 1 to 6, characterised in that a fluorine-, nitrogen- or sulphur-substituted hydrocarbon compound is used as an organic compound.
8. Process according to claim 1, characterised in that a substrate is coated with two to four gases of the groups consisting of CO_2 , CH_4 , O_2 , C_2H_2 , NH_3 and Ar.
9. Process according to claim 8, characterised in that a substrate is coated with a process gas of CO_2 , C_2H_2 and Ar, preferably in the volume ratio of 4:1:1.
10. Process according to claim 8, characterised in that a substrate is coated with a process gas of NH_3 , CO_2 , CH_4 and Ar, preferably in the volume ratio of 2:1:1:1 or 2:2:1:1.
11. Process according to claim 8, characterised in that a substrate is coated with a process gas of CO_2 and CH_4 , preferably in the volume ratio of 2:1 or 4:1.
12. Process according to claim 8, characterised in that a substrate is coated with a process gas of CO_2 , CH_4 and Ar, preferably in the volume ratio of 3:3:1 or 4:1:1.
13. Process according to claim 8, characterised in that a substrate is coated with a process gas of CO_2 and Ar, preferably in the volume ratio of 4:1.
14. Process according to claim 8, characterised in that a substrate is coated with a process gas of CH_4 , O_2 and Ar, preferably in the volume ratio of 1:1:1.
15. Process according to claim 8, characterised in that a substrate is coated with a process gas of CO_2 , CH_4 , O_2

and Ar, preferably in the volume ratio of 1:2:1:2 or 1:4:1:2.

16. Process according to claim 8, characterised in that a substrate is coated with a process gas of CH_4 , NH_3 and Ar, preferably in the volume ratio of 2:2:1, 1:4:1 or 1:2:1.
17. Polymer coating of a substrate produced by means of a process according to any of claims 1 to 7, characterised in that the polar coating has an initial surface tension of $< 45 \text{ mN/m}$ which remains unchanged for at least one year.
18. Use of the process according to any of claims 1 to 16 for coating polymer flexible substrates, polymer substrates reinforced with ceramic fibres, glass fibres, polymer fibres and/or carbon fibres, and powder- or granulate-formed substrates for production of a polar film or a polar moulded body.
19. Use of the process according to any of claims 1 to 16 for coating packing materials such as in particular films, bottles and other containers, and substrates for adhesion of composite materials.
20. Use of the process according to any of claims 1 to 16 for coating ceramic or metal substrates.